ADL-11XX

Data Logger for Toxic Gases
Serial No. MA-004

User Manual

March, 2012

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GAADL11XX_E_0312

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Data Logger with Electro-chemical Gas Sensor for Toxic Gases

1 Intended Use

The data logger is used for recording toxic gases in indoor areas.

The intended sites are all areas within the ambient conditions as defined in the Technical Data.

The data logger must not be used in potentially explosive atmospheres.

This User Manual doesn't explain the handling of toxic gases. For the handling please consult the safety data sheet of the corresponding gases.

The data logger is only used for recording present gas concentrations. It is not suitable for the safety-relevant monitoring or warning against toxic gases.

2 Functional Description

2.1 Electro-chemical Sensor

The sensor portion of the transmitter is a sealed electro-chemical cell. The ambient air to be monitored diffuses through a membrane filter into the liquid electrolyte of the sensor. The chemical process of the measurement is one of oxidation where one molecule of the target gas is exchanged for one molecule of oxygen. The reaction drives the oxygen molecule to the counter electrode, generating a current signal (nA) between the two electrodes. This signal is linear to the volume concentration of the sensed gas. The signal is evaluated by the connected amplifier and transformed into a linear 0 to 5 V signal.

Electrochemical processes always lead by-and-by to a loss of sensitivity. Therefore regular calibration of zero-point and gain with the potentiometers Zero and Gain is necessary.

There is a small quantity of corrosive liquid in the sensor element. If in case of damage persons or objects touch the liquid, you have to clean the affected areas as fast and carefully as possible with tap water. Out of use sensors must be disposed in the same way as batteries.

2.2 Data Logger

The electro-chemical sensor is supplied by an internal maintenance-free 12 V rechargeable battery. At full charge the operating time is about 16 days, but the deep discharge protection switches automatically to off when reaching the deep discharge voltage of 10.5 V.

The data logger T-Logg 120 is supplied – independently from the rechargeable battery – by a separate battery with a lifetime of 3 years. The data stored in the T-Logg, however, survive in the internal memory and aren't lost.

Further information can be taken from the User Manual T-Logg 120.

The sensor measures the gas concentration within the defined range of 0 – X ppm. The measured value is transmitted to the T-Logg 120 in 0 – 5 V signal form, with 200 mV corresponding to 0 ppm (Zero) and 4700 mV corresponding to the full scale value.

In the OFF position of the operation mode switch, the electro-chemical sensor is voltage-free; the sensor output signal is 0 V. The T-Logg 120 interprets 0V as Low Alarm. The display changes to LoAl.

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After configuration with the software MINISOFT, the recording is started via the operation mode switch when brought to position “Record”. The gas sensor is ready for use within a couple of seconds and the T-Logg starts recording.

T-Logg configuration:

Display range: 0 – XXX ppm (depending on the measuring range of the sensor)

Measuring range: 200 – 4700 mV. (Output signal of gas sensor = 200m V (0 ppm) to 4700 mV (XXX ppm), therefore limitation of the display range to XXXX ppm.)

LoAl.. < 0 ppm. Measuring signal < 180 mV = Record OFF / battery empty / Fault in the measuring system.

HiAl: > Measuring range Measuring signal > 4800 mV = Fault in the measuring system.

Start of recording: If no alarm is active.

3 Commissioning/ Measuring

3.1 Pre-arrangements Data Logger

Prior to starting of the records, the 12 V lead battery has to be charged by means of the charger ALCS 2-24A according to the IU characteristics. The ALCS is connected to the socket “Charging” with the jack plug. The charging voltage as well as the charging itself are automatically regulated and monitored. The green LED signals the charging voltage (12V).The charging is shown by the red LED “Charge”. Only if this LED goes out, the battery is fully charged.

The ALCS is suitable for the trickle charge as well as for stand-by and parallel operation.

The operation mode switch should be in OFF position during charging for fast charging.

Only after full charge of the battery, the maximum operating time of 16 days can be obtained.

In the position “Record” of the operation mode switch, the gas sensor is supplied by the battery, so the discharge starts from that time on. Therefore it is advisable to bring the switch into position “Record” only when starting the recording.

Prior to recording, the configuration, as well as time and date are checked and corrected at the T-Logg 120 by means of the software MINSOFT.

Then the data from the last recording are deleted and the records are started anew.

3.2 Positioning

The Data Logger must be situated in a way so that the gas inlet is not blocked. The data logger should only be located in areas with low streams of air to get exact results. Corners, niches and areas with intense streams of air have to be avoided. The mounting height depends on the relative density of the gases to be sensed. You can read the recommended mounting height from table 1.

3.3 Commissioning

After positioning of the Data Logger, the recording is started by turning the operation mode switch to position “Record”. The display changes from LoAl to the measured gas concentration.

3.4 Readout and Processing of the Data

The data are readout with time and date stamp via the supplied serial USB interface by means of the software MINSOFT. This procedure as well as the data processing can be taken from the User Manual T-Logg 120.

4 Calibration of the Transmitter

Prior to calibration the sensor element must be fully stabilized by applying power voltage for a certain time (see table 1) without interruption.

Required instruments for calibration of the transmitter:

- Test gas bottle with synthetic air (20 % O_2, 80 % N) or measuring gas-free ambient air.
- Test gas bottle with calibration gas in the range of 30 – 70 % of the measuring range. Rest is synthetic air.
- Set out of gas pressure regulator and flow meter.
- Calibration adapter with tube, type Calibration set 7. See fig. 3.
- Digital voltmeter with range 0 – 10 VDC, accuracy 1%
- A small screwdriver.

4.1 Zero-point Calibration

- Open cover of enclosure.
- Connect digital voltmeter to pin 2 (signal) and 3 (ground) for zero-point calibration.
- Connect calibration adapter carefully to the sensor element.
- Apply synthetic air (flow rate see table 1; 1 Bar (14.5 psi) ± 10%), or measuring gas-free ambient air.
- Wait 1 minutes until the signal is stable, then adjust signal with potentiometer ”Zero” until the signal is 200 mV ± 1 mV and stable (= 0ppm)

4.2 Gain Calibration

- Connect calibration adapter to the sensor element.
- Connect digital voltmeter to pin 2 (signal) and 3 (ground).
- Apply calibration gas (30 – 70 % of measuring range, flow rate see table 1; 1 Bar (14.5 psi)).
- Wait two minutes until the signal is stable, adjust signal with potentiometer ”Gain” until the signal corresponds to the calculated value, see calculation for control voltage 4.3, ± 2 mV and is stable.

At a loss of sensitivity of more than 70% caused by ageing, operational or climatic influences, calibration will not be possible any more. Then the sensor has to be replaced.

4.3 Calculation of Control Voltage

$$\text{Control voltage (mV)} = \frac{4700\ (\text{mV}) \times \text{test gas concentration (ppm)}}{\text{measuring range (ppm)}} + 200\ (\text{mV})$$

Example: CO measurement

Measuring range CO	300 ppm
Test gas concentration	200 ppm CO
Control voltage	3333 mV

$$\frac{4700\ (\text{mV}) \times 200\ (\text{ppm})}{300\ (\text{ppm})} + 200\ (\text{mV}) = 3333\ \text{mV}$$

Control voltage: (mV)
Zero calibration: 200 mV ±2 mV
Gain calibration: = $\frac{\text{4700 mV x test gas concentration (ppm)}}{\text{Measuring range (ppm)}}$ + 200 mV

Fig. 1

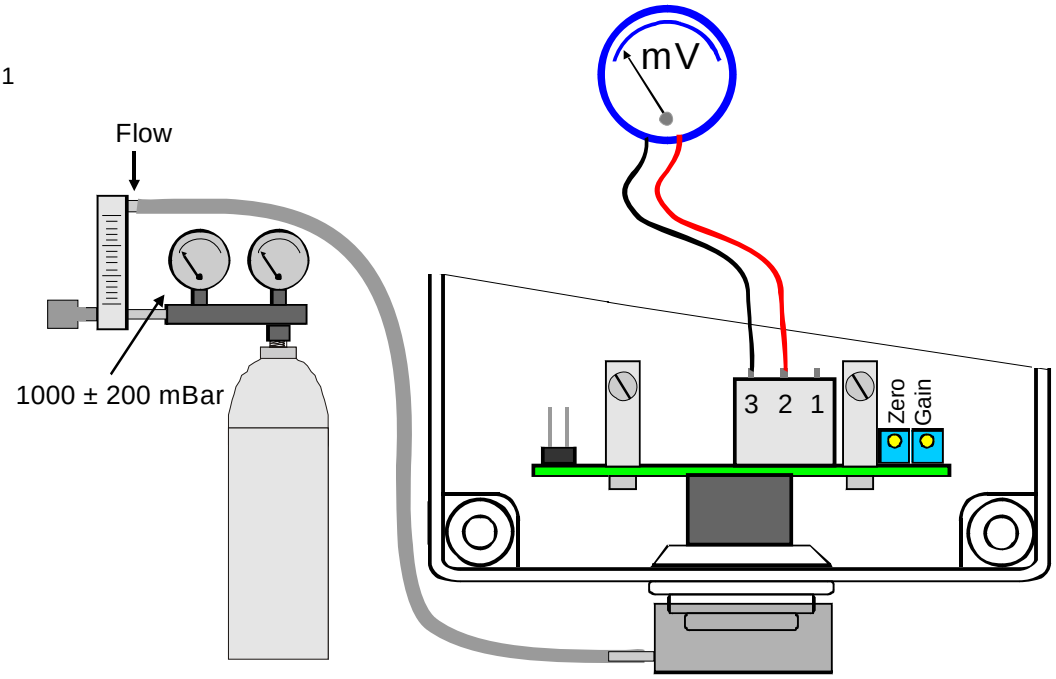

Table 1: Gases

Gas type	Formula	Order No. ADL-..	Measuring range (ppm)	Sensor lifetime > (months)	Mounting height	Warm-up time (h)	Flow rate (ml/min)
Carbon monoxide	CO	01-1110	300	60	1.5-1.8	1	150
Carbon monoxide	CO	51-1110	2000	36	1.5-1.8	1	150
Ammonia	NH3	21-1120	300	36	Ceiling	18	300
Nitrogen oxide	NO	21-1129	20	36	Ceiling	4	150
Nitrogen dioxide	NO2	21-1130	20	48	0.6-0.8	6	300
Chlorine dioxide	CLO2	61-1181	1	24	0.2-0.3	6	150
Hydrogen fluoride	HF	61-1182	10	18	Ceiling	6	300
Hydrogen cyanide	HCN	51-1183	100	24	Ceiling	6	300
Formaldehyde	CH2O	51-1185	10	36	0.6-0.8	24	300
Hydrogen chloride	HCL	51-1186	20	24	0.6-0.8	1	150
Phosphine	PH3	51-1187	5	24	0.6-0.8	6	150
Silane	SiH4	61-1188	50	24	0.6-0.8	6	150
Ethylene	C2H4	51-1189	10	24	1.5-1.8	6	150
Ozone	O3	51-1190	5	24	0.2-0.3	6	150
Chlorine	Cl2	51-1193	20	24	0.2-0.3	6	150
Oxygen	O2	91-1195	25 (vol%)	24	1.5-1.8	1	150
Sulphur dioxide	SO2	21-1196	50	24	0.2-0.3	6	300
Hydrogen sulphide	H2S	51-1197	50	24	0.6-0.8	6	150
Fluorine	F2	61-1198	1	18	0.6-0.8	6	150

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5 Specifications

Electrical	
Supply voltage	12 V DC
Power consumption	Ca. 2 mA
Sensor data	
Gas type	Toxic gases, see table 1
Sensor element	Electro-chemical
Measuring range	0 – XXX ppm (depending on gas type and measuring range)
Accuracy	± 3% of measuring range
Repeatability	± 3 % of reading
Response time	$t_{90} \leq$ 60 s
Correct function after switch-on	immediately
Expected life time of sensor	See table 1/ normal operating environment
Output signal	
Analog output signal	0 – 5 VDC proportional
Ambient conditions	
Humidity	15 – 90 % RH non condensing
Temperature	0 °C to + 50 °C (32°F to 122 °F)
Temperature storage	5 °C to + 50 °C (41°F to 122 °F)
Pressure range	Atmosphere ± 10 %
Battery data	
Voltage	12 VDC
Capacity	0.8 Ah
Supply duration	ca. 16 days at full charge
Deep discharge voltage	10.6 V
Type	Lead battery
Charger	
Supply voltage	230 VACV/ 50 Hz
Output voltage	2, 6, 12, 24 VDC (automatic adjustment to battery)
Charging characteristics	IU
Trickle charge	ca. 20 mA
Capacity range	2.4 – 24 Ah
Charging current	350 mA at 12 V
Physical	
Housing	Polycarbonate
Flammability	UL V94
Colour	RAL 7032 (light grey)
Dimensions	(B x H x T) 97 x 130 x 81 mm
Weight	Ca. 0.95 kg
T-Logg 120	See User Manual T_Logg 120
Directives	EMC Directives 2004 / 108 / EEC; CE
Warranty	1 year on material (without sensor)

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6 Figures

Fig.2

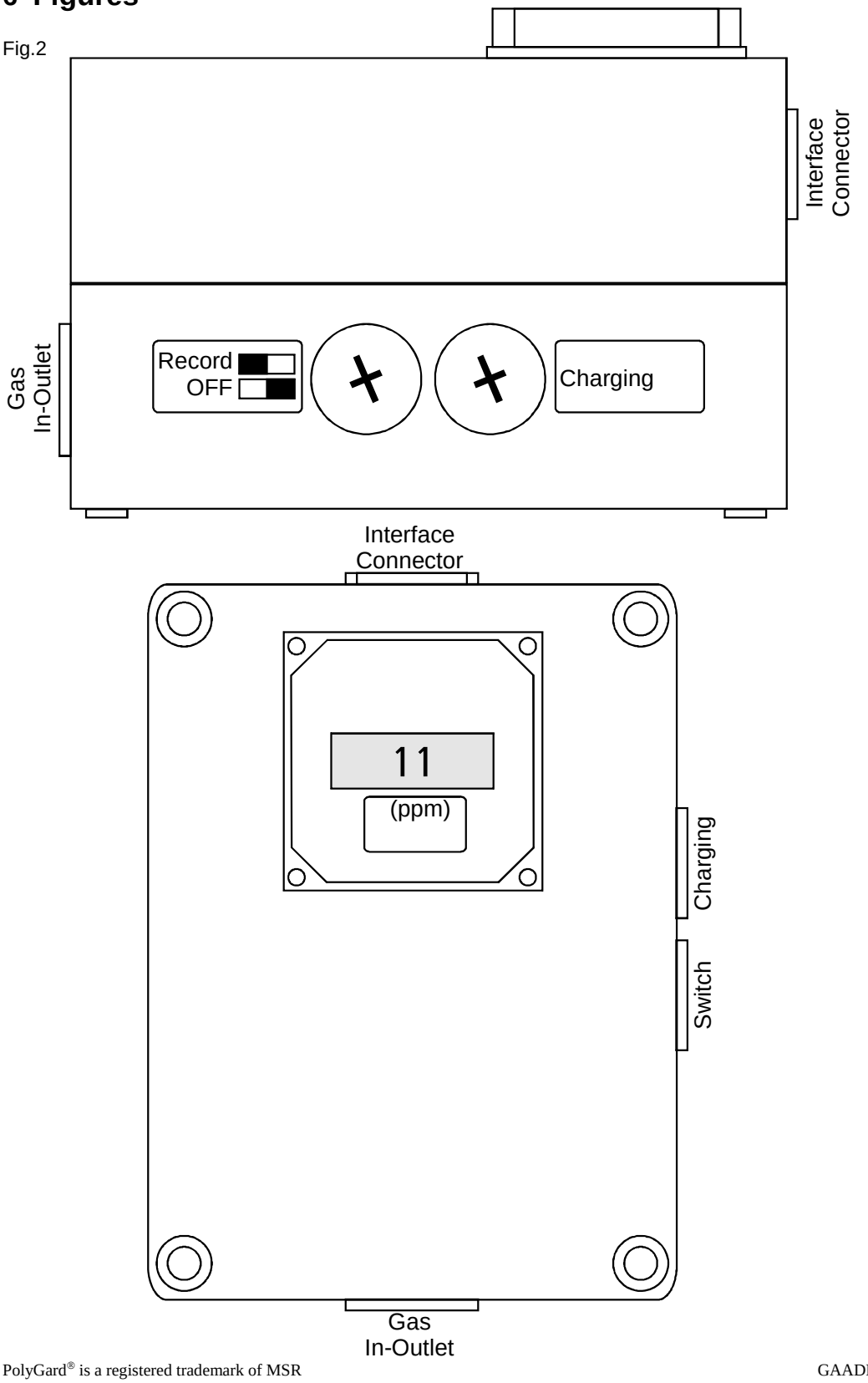

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Fig. 3
Calibration adapter Calibr. Set 7

7 Part Disposal

Since August 2005 there are EC-wide directives defined in the EC Directive 2002/96/EC and in national codes concerning the waste electrical and electronic equipment and also regarding this device.

For private households there are special collecting and recycling possibilities. For this device isn't registered for the use in private households, it mustn't be disposed this way. You can send it back to your national sales organisation for disposal. If there are any questions concerning disposal please contact your national sales organisation.

Outside the EC, you have to consider the corresponding directives.

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8 Notes and General Information

For the installation of the device and the operation, it is important to read this user manual thoroughly. The ADL must be used within product specification capabilities. The appropriate operating and maintenance instructions and recommendations must be followed.

Due to on-going product development, MSR reserves the right to change specifications without notice. The information contained herein is based upon data considered to be accurate. However, no guarantee is expressed or implied regarding the accuracy of this data.

8.1 Intended Product Application

The ADL is designed and manufactured for control applications, energy-savings and air quality compliance in commercial buildings and manufacturing plants.

8.2 Installers' Responsibilities

It is the installer's responsibility to ensure that the ADL is installed in compliance with all national and local codes and OSHA requirements. Installation should be implemented only by technicians familiar with proper installation techniques and with codes, standards and proper safety procedures for control installations and the latest edition of the National Electrical Code (ANSI/NFPA70). It is also essential to follow strictly all instructions as provided in the user manual.

8.3 Maintenance

It is recommended to check ADL regularly. Due to regular maintenance any performance deviations may easily be corrected. Re-calibration and part replacement in the field may be implemented by a qualified technician and with the appropriate tools. Alternatively, the ADL may be returned for service to MSR-Electronic-GmbH.

8.4 Limited Warranty

MSR-Electronic-GmbH warrants the ADL for a period of one (1) year from the date of shipment against defects in material or workmanship. Should any evidence of defects in material or workmanship occur during the warranty period, MSR-Electronic-GmbH will repair or replace the product at their own discretion, without charge.

This warranty does not apply to units that have been altered, had attempted repair, or been subject to abuse, accidental or otherwise. The warranty also does not apply to units in which the sensor element has been overexposed or gas poisoned. The above warranty is in lieu of all other express warranties, obligations or liabilities.

This warranty applies only to the ADL. MSR-Electronic-GmbH shall not be liable for any incidental or consequential damages arising out of or related to the use of the ADL.

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